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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/752,541	12/29/2000	Stephen Boyd	4363P001	1435

7590 02/11/2004

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EXAMINER	
VU, TUAN A	
ART UNIT	**PAPER NUMBER**
2124	5

DATE MAILED: 02/11/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 10/03)

Office Action Summary	Application No.	Applicant(s)	
	09/752,541	BOYD ET AL.	
	Examiner	Art Unit	
	Tuan A Vu	2124	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _29 December 2000_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-22_ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _1-22_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _29 December 2000_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _4_.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

1. This action is responsive to the application filed 12/29/2000.

Claims 1-22 have been submitted for examination.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Shao-Po et al., "A Parser/Solver for Semidefinite Programs with Matrix Structure", Technical Report, Information System Laboratory, Stanford University, November 1995 (hereinafter Shao-Po – provided in IDS), in view of Hershenson et al., USPN: 6,311,145 (hereinafter Hershenson).

As per claim 1, Shao-Po discloses a parser program to parse mathematical optimization problems, where a optimization language (*spdsol* language – ch. 4.1.4, pg. 81) is converted from a set of algebraic expressions (e.g. eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81) to a compact numeric format that can be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify that the optimization program is a geometric program; nor does Shao-Po disclose converting a set of algebraic expressions to a numeric format that can be accepted by a geometric program solver. Shao-Po discloses parser/solver implemented method for optimizing of circuit design (ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) using a *sdpsol* language programming (e.g. ch. 4.2.3 pg. 83-84). Hershenson, in a analogous method to Shao-

Po's to optimize a circuit design lumping circuits parametric constraints into a specific set of expressions, discloses optimizing complex non-linear circuit problems (e.g. induction or RF mathematics like Shao-Po spring system) and expressing the constraints or inequalities into posynomials and submitting these to solver using a geometric programming language (e.g. Fig. 1; col. 5, line 34 to col. 10, line 45). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the constraints as taught by Shao-Po into posynomial expressions as taught by Hershenson if available resources are such that Hershenson's geometric programming language can be implemented because this geometric programming technology operating upon convex or non-linear complex functions can be an efficient tool for effecting improved algorithms to solve problems like those non-linear complex inductive circuitry; and optimizing circuit designs as mentioned by Shao-Po, by solving constraints formed as posynomial, or synomials as claimed (see Hershenson, col. 1, 2).

As per claim 2, Shao-Po discloses an objective (eq. 4.1- pg. 79) and a set of constraints (e.g. *constraint lyap, constraint equ* – ch. 4.2.2 pg. 84).

As per claim 3, Shao-Po discloses one or more mathematical expressions (e.g. ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) and inequality (e.g. *Lyapunov inequality* – ch. 4.4.1, pg. 86).

As per claim 4, Shao-Po discloses optimization variables (matrices, vector – ch. 4.2.3 – pg. 83- Note: matrix or structures used for the optimization process are optimization variables).

As per claim 5, Shao-Po discloses a computer-implemented method of parsing a mathematical optimization problem comprising:

reading a plurality of algebraic expressions that represent a mathematical problem, each algebraic expression in said plurality having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

creating a set of mathematical expressions or constraints from the mathematical terms(e.g. *equality constraints* - ch. 4.3.1 pg. 85; *Lyapunov inequality* - ch. 4.4.1, pg. 86);

converting said set of constraints expressions to a optimized numeric format to be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify that the mathematical terms or constraints are converted into a set of signomial expressions; nor does Shao-Po specify converting those set of signomial expressions into a compact numeric format accepted by the program solver. Shao-Po discloses parser/solver implemented method for optimizing of circuit design (ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) using a *sdpsol* language programming (e.g. ch. 4.2.3 pg. 83-84). Hershenson, in a analogous method to Shao-Po's to optimize a circuit design lumping circuits parametric constraints into a specific set of expressions, discloses optimizing complex non-linear circuit problems (e.g. induction or RF mathematics like Shao-Po spring system) and expressing the constraints or inequalities into posynomials and submitting these to solver using a geometric programming language (e.g. Fig. 1; col. 5, line 34 to col. 10, line 45). It would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the constraints as taught by Shao-Po into signomial expressions as taught by Hershenson if the resources are such that Hershenson's geometric programming language can be implemented because this widely known programming technology operating upon convex or non-linear

complex functions can be an efficient tool for effecting improved algorithms to solve problems like those non-linear complex inductive circuitry; and optimizing circuit designs as mentioned by Shao-Po, by solving constraints formed as posynomial, or synomials as claimed (see Hershenson, col. 1, 2).

As per claim 6, Shao-Po discloses an objective (eq. 4.1- pg. 79) and a set of constraints (e.g. *constraint lyap, constraint equ* – ch. 4.2.2 pg. 84).

As per claim 7, Shao-Po discloses one or more mathematical expressions (e.g. ch. 4.1, pg. 79; Fig. 4.1 – pg. 87; Fig. 4.4, pg. 90) and inequality (e.g. *Lyapunov inequality* – ch. 4.4.1, pg. 86).

As per claim 8, Shao-Po discloses optimization variables (matrices, vector – ch. 4.2.3 – pg. 83- Note: matrix or structures used for the optimization process are optimization variables)

As per claim 9, Shao-Po discloses before converting determining that the mathematical expressions reduce to objective or inequality or equality (e.g. ch. 4.2.2-4.2.3 pg. 83-84); but does not specify reducing expressions into signomial expressions or determining that such optimization problem is a geometric program. This limitation, however, would have been obvious in view of the rationale set forth in claim 5 using Hershenson's teachings.

As per claim 10, only Hershenson discloses that some expressions are not posynomial expressions (col. 7, line 56 to col. 8, line 27). In light of the rationale set forth in claim 5, it would have been obvious for one of ordinary skill in the art at the time the invention was made to implement the step of determining which expressions are not fit to be into posynomial form as taught by Hershenson and apply it to the problem solving using constraints-based optimization language by Shao-Po; because if the purpose is to convert complex functions constraints and

parameters into posynomial forms, it is required to only focus on creating posynomial expressions and filter out non-posynomial expressions in order to conform to the geometric programming as suggested by Hershenson.

But neither Shao-Po nor Hershenson discloses reporting to a user which expressions cannot be reduced into a posynomial objective or equality/inequality. The implemention of user interface in computer-implemented hardware/software design or circuit emulation framework in order to allow user to author or specify requirements and receive feedback from constraints compatibility checking was a known concept in the programming art at the time the invention was made, especially when such design involve CAD tools as suggested by Hershenson (col. 1, 2) or *LMITool* by Shao-Po (e.g. ch. 4.1.4 - pg. 82). It would have been obvious for one of ordinary skill in the art at the time the invention was made to add to the combination of Hershenson/Shao-Po an user interface allowing the user to interact with the circuit design and algorithmic programming as suggested by Hershenson; as well as the reporting to the users to the effect that some expressions fail to be reduced into posynomial objective or equality/inequality as claimed above. The motivation is that this would allow the user to specify and learn upon the results of such requirement acceptance by the framework or optimization of parameters used in implementing the functions of the circuitry, as applied by common known methodologies like HDL, Verilog-based hardware/software circuit designs.

As per claim 11, the reduction of simple monomial expressions into more posynomial has been taught and addressed in claim 5 (see Hershenson: col. 5, line 34 to col. 10, line 45-- Note: the monomial expressions representing signal mathematics in a circuitry used to be converted in more complex posynomial are mathematical expressions expressing signals, hence

signomial); but Hershenson does not explicitly specifying canceling a combination of signomials. Official notice is taken that simplication of mathematical expressions prior to submitting them to more complex integrations was a known concept at the time the invention was made. Hence it would have been obvious for one of ordinary skill in the art at the time the invention was made to provide the simplification by canceling out signomial combinations in view of the in both optimization methods by Hershenson or Shao-Po, and apply such canceling to Hershenson's method as it enhances the optimization method by Shao-Po as set forth in claim 5 because simplifying a mathematical expression or in this case signomial combination is a must-do step in computation lest extraneous data complications and resources wasting down the later computing stages occur.

As per claim 12, Shao-Po discloses a computer-implemented method of parsing a mathematical optimization problem comprising:

reading a plurality of algebraic expressions that represent a mathematical problem, each algebraic expression in said plurality having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

identifying a plurality of algebraic expressions or constraints from the mathematical terms (e.g. *inequality* - ch. 4.2.2 pg. 83);

converting said plurality of algebraic expressions to a optimized numeric format to be accepted by a computer-based program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify identifying that the algebraic expressions form a geometric program; nor does Shao-Po specify converting those set of algebraic expressions into a compact

numeric format accepted by a computer-aided geometric program solver. But these limitations have been addressed in claim 5 above.

As per claims 13-15, refer to corresponding claims 6-8 for respective rejection.

As per claim 16, Shao-Po does not specify creating prior to identifying a set of signomial expressions by converting mathematical terms to a signomial; but this limitation has been addressed in claim 5 from above. Nor does Shao-Po disclose, after creating, determining if said signomials in said set reduce in posynomial objective or equality/inequality. But these limitation has been addressed by virtue of the rationale in claim 9.

As per claim 17, this limitation would have been obvious in view of the rationale as set in claim 5 and 9 from above.

As per claim 18, Shao-Po discloses a computer-readable medium for parsing a optimization program, comprising: an interface (*LMITool* – ch. 4.1.4, pg. 82) to accept a plurality of algebraic expressions that represent a optimization problem, each algebraic expression having one or more mathematical terms (e.g. *minimize* -, eq. 4.1, pg. 79; eq. 4.2 pg. 80; eq. 4.3 – pg. 81);

a verifier to identify that said algebraic expressions form a optimization constraint or optimization expression/objective (e.g. ch. 4.2.2 – pg. 83);

a matrix generator coupled to said verifier to convert said algebraic expressions to a compact numeric format for a computer-aided program solver (e.g. *matrix* 4.14 – pg. 87; *spdsol* language & equ. 4.15 – pg. 89).

But Shao-Po does not specify a verifier to identify that said algebraic expressions form a geometric program; nor accepting of a compact numeric format by a geometric program solver.

But in view of the teachings by Hershenson from above, these limitations are rejected herein using the rationale as set forth in claim 5 above.

As per claims 19-21, refer to claims 6-8, respectively.

As per claim 22, this claim corresponds to claim 11, hence is rejected with the same grounds as set forth therein.

Conclusion

4. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Rajgopal et al., " Robustness of Posynomial Geometric Programming Optima", Mathematical Programming, Vol. 85, pp. 423-431, 1999; disclosing converting algebraic expressions into primal variables and using optimization vectors.

Rajgopal, "posy.for", directory /dept/ie/GP at ftp.pitt.edu; 07/22/1996; disclosing reading constraints and forming posynomial structures.

Rajgopal, "gpposy.for", directory /dept/ie/GP at ftp.pitt.edu; 07/22/1996, disclosing deallocating inappropriate optimization format structures and iteratively creating new posynomials.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tuan A Vu whose telephone number is (703)305-7207. The examiner can normally be reached on 8AM-4:30PM/Mon-Fri.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kakali Chaki can be reached on (703)305-9662.

Any response to this action should be mailed to:

Commissioner of Patents and Trademarks

Washington, D.C. 20231

or faxed to:

(703) 872-9306 (for formal communications intended for entry)

or: (703) 746-8734 (for informal or draft communications, please label "PROPOSED" or "DRAFT" – please consult Examiner before use)

Hand-delivered responses should be brought to Crystal Park II, 2121 Crystal Drive, Arlington. VA. , 22202. 4th Floor(Receptionist).

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-3900.

VAT
February 9, 2004

TODD INGBERG
PRIMARY EXAMINER